

Environmental Studies Program: Ongoing Studies

Study Area(s): National

Administered By: Marine Minerals Program

Title: Sediment Sorting During Coastal Restoration Projects:
Implications for Resource Management, Environmental
Impacts, and Multiple Use Conflicts

BOEM Information Need(s) to be Addressed: BOEM needs to determine the extent of sediment sorting during dredging, handling, and placement processes. This can be accomplished by quantifying the losses and percent changes of fine-grained material through the full dredging life-cycle, by comparing measurements of in situ borrow area grain size characteristics (i.e., core samples) to measurements of placed material. BOEM needs to address this to determine if alternative borrow areas containing higher fractions of fine-grained material could be deemed as suitable sources for coastal restoration projects. By determining the percent of fine-grained losses during each phase of dredging, environmental trade-offs and impacts assessments can be better informed. This study will be conducted in partnership with USACE.

Total Cost: (in thousands) \$400

Period of Performance: FY 2016-2018

Conducting Organization(s): Inter-Agency Agreement – U.S. Army Corps of Engineers (USACE) Jacksonville District (USACE is contributing additional funds towards the study)

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Description:

Background: Coastal restoration project managers must ensure that borrow area sediments are compatible with native beach sediments with regard to sediment grain size and sorting. These requirements exist because sediment characteristics, in part, dictate beach fill performance, recreational experience, and the type and severity of environmental impacts along the beach during and after nourishment. For example, use of too fine-grained sediment could result in early and significant erosion due to the wave climate of a particular stretch of coastline. To satisfy these beach fill requirements and obtain compatible sediment in sufficient quantity, many beach nourishment project sponsors are moving towards potentially more environmentally sensitive areas (i.e., offshore sand ridges, cape associated shoals, etc.).

Beach fill compatibility is currently based on a comparison of in situ borrow area and native beach sediment samples; however, this approach only provides a partial comparison of sediment characteristics and does not reflect the changes that could occur during various dredging and placement operations. For example, during TSHD operations, seabed sediments are agitated into a slurry, excavated off the seafloor, and conveyed into the dredge's hopper. Once in the hopper, coarse sediments settle out for

future pump-out while suspended fine sediments are subsequently discarded (i.e., “overflow”). This overflow process results in a functional coarsening of sediment within the hopper. The current methods for assessing sediment compatibility do not adequately reflect the percent of these fine-grained sediments (i.e., <#200 sieve) ultimately retained in the hopper and subsequently pumped out, placed, and retained on the beach.

The purpose of this study is to acquire greater understanding of changes in sediment characteristics through the dredging and placement process associated with coastal restoration projects to determine the extent of potential coarsening and to better inform sediment compatibility analyses. The degree of coarsening could potentially increase available volumes of offshore sediment available for coastal restoration projects to support coastal resiliency including infrastructure and environmental habitat. Information gained as part of the project support informed management of offshore sediment resources and potentially reduce environmental impacts and multiple use conflicts.

Objectives: The objective of this study is to quantify changes in sediment characteristics (i.e., grain size, sorting) and the degree, timing, and variability of sediment sorting during dredging, pump-out, and placement operations to determine the extent of potential sediment coarsening and to better inform sediment compatibility analyses and subsequent management of offshore sand resources. A question to be answered is whether OCS sediment resources containing higher fine sediment percentages would be considered compatible for placement on the beach when considering the extent of sediment coarsening. If alternative borrow areas, characterized by sand with relatively higher fractions of finer material, could be used, different environmental tradeoffs could be considered, and/or different environmental outcomes could be realized.

Methods: Field methods to determine potential sediment sorting and character changes in context of seasonal, inter-annual, and event-driven variability could include repeat sediment sampling, concurrent oceanographic and turbidity/suspended sediment measurements, and sediment tracer studies. During operations, sampling must be conducted in four steps: (1) at the borrow area, (2) within the hopper, (3) from pipeline discharge, and (4) at the nourished beach. A laboratory analysis must be conducted to ascertain sediment grain size, color, sorting, flocculation behavior, and settling velocity. An ADCP backscatter/particle imaging videography could be used to document sediment transport and settling dynamics and quantify overflow losses. Robust sampling strategies and statistical analyses will be required to distinguish any changes in sediment properties during each of the operational phases. Existing research efforts, including required construction monitoring, will be identified and leveraged. Specific tasks include (1) Conducting a literature review and development of a conceptual model, (2) Proof of concept and development of a field sampling plan based on controlled experiments and analyses in a laboratory setting, (3) Field sampling aboard USACE and Contract dredges and laboratory analyses, and (4) Preparation of a final report.

Current Status: A final literature review, concept model report, conceptual field sampling plan, and controlled experiments have been completed. Execution of hopper dredge field sampling measurements is currently scheduled to occur in the Winter of

2018 in association with the Ship Island component of the Mississippi Coastal Improvements Project (MsCIP). A second round of field sampling is scheduled for Summer 2018.

Final Report Due: August 2018

Publications Completed: N A

Affiliated WWW Sites: NA

Revised Date: January 29, 2018